Planning Community of Practice
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Adaptations to Climate Change: A Comprehensive Systems Approach

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ACTIONS for CHANGE

Outline

- **Potential Effects of Climate Change on USACE Missions and Systems**
  - **Sea Level Change Guidance**
  - **Water Management and Climate Change**
- **USACE Activities for Climate Change**
  - **Actions for Change - Temporal and Spatial System Changes**
  - **USACE Policy, Procedures and Guidelines Team for Adaptations to Climate Change**
  - **Interagency Workgroups on Climate Change and Water Resources and Coastal Issues**

ACTIONS for CHANGE

Potential Effects of Climate Change on USACE Missions and Systems

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Potential Climate Change Impacts

- **Increase in temperatures**
- **Potential increases in drought severity and frequency**
- **Potential increases in intensity of precipitation; more frequent “heavy” precipitation events**
- **Sea level rise**
- **Potential increases in intensity, frequency, size of hurricanes**

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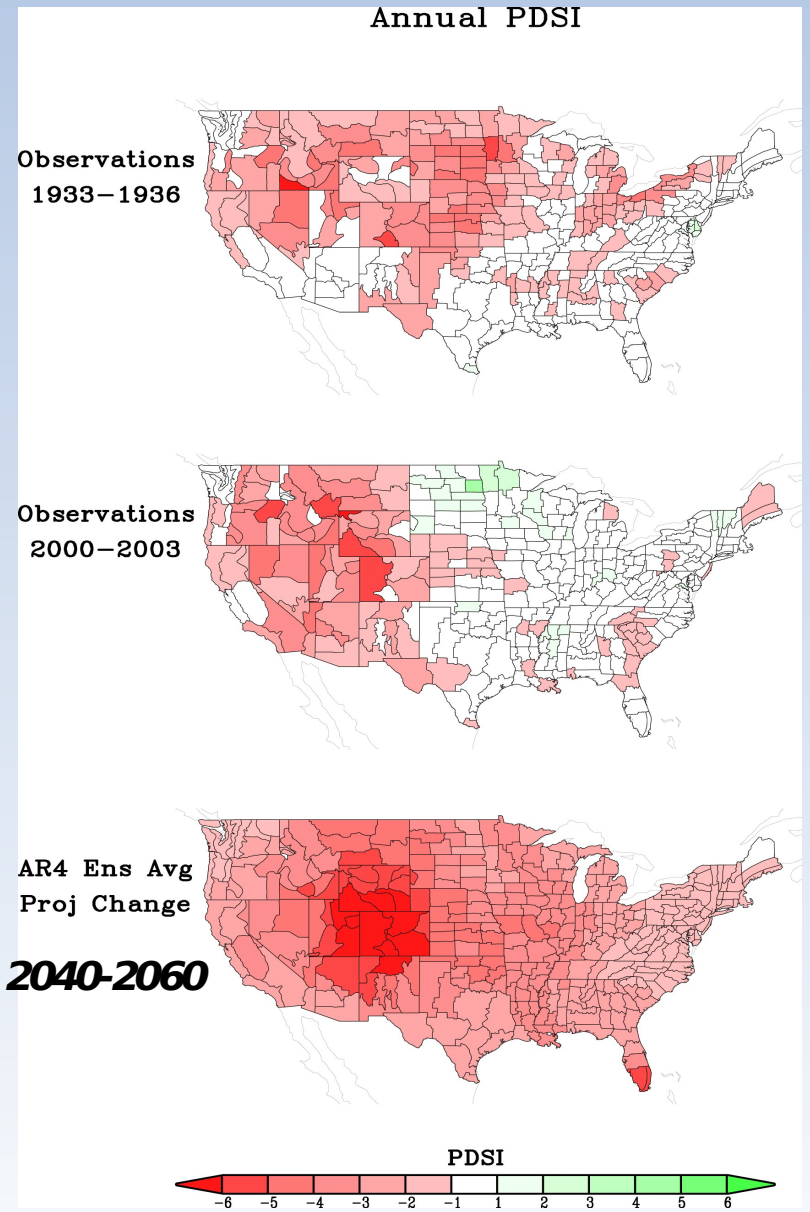
Drought Projections

- **Projections of drought in 2040 to 2060 in the United States using an ensemble of climate models for the IPCC Fourth Assessment Report**
- **Parameter is the Palmer Drought Severity Index (PDSI)**



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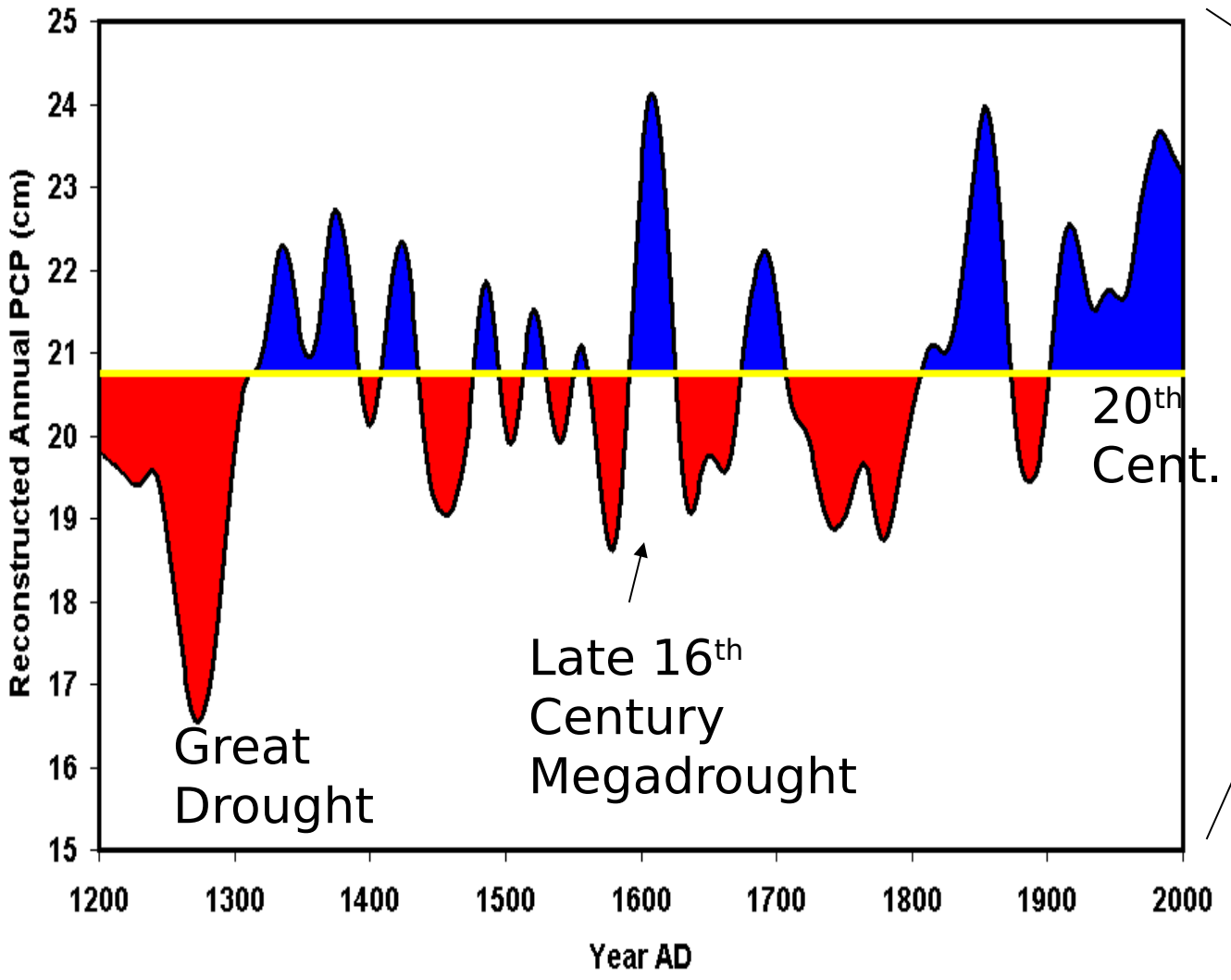
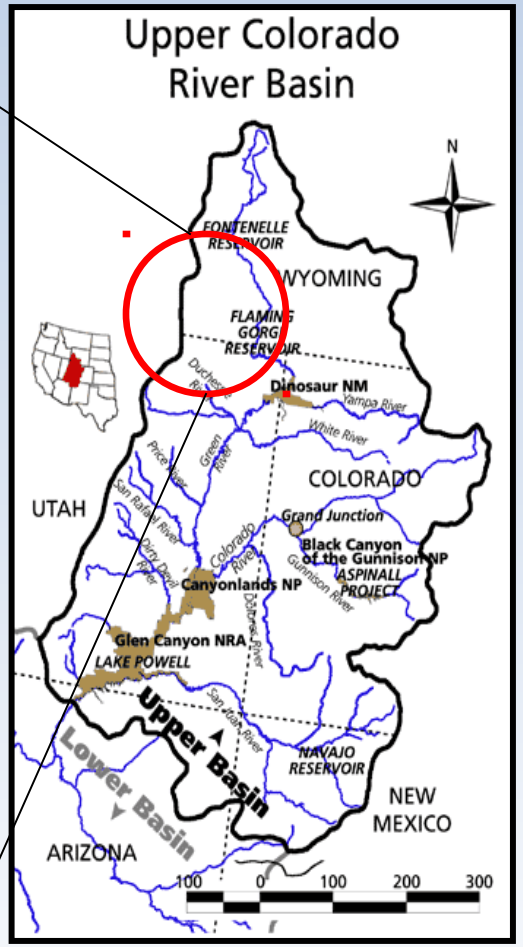
Climate Reconstructions

Uinta Basin Watershed: 50-yr Running Average





Gray, Jackson, Betancourt (2004)

USGS

Drought Trends

- **Generally continental U.S. has become wetter in recent decades reflected by trends in soil moisture and streamflow**
- **Some increases in drought severity and duration in western and southwestern US**

Precipitation and Flood Trends

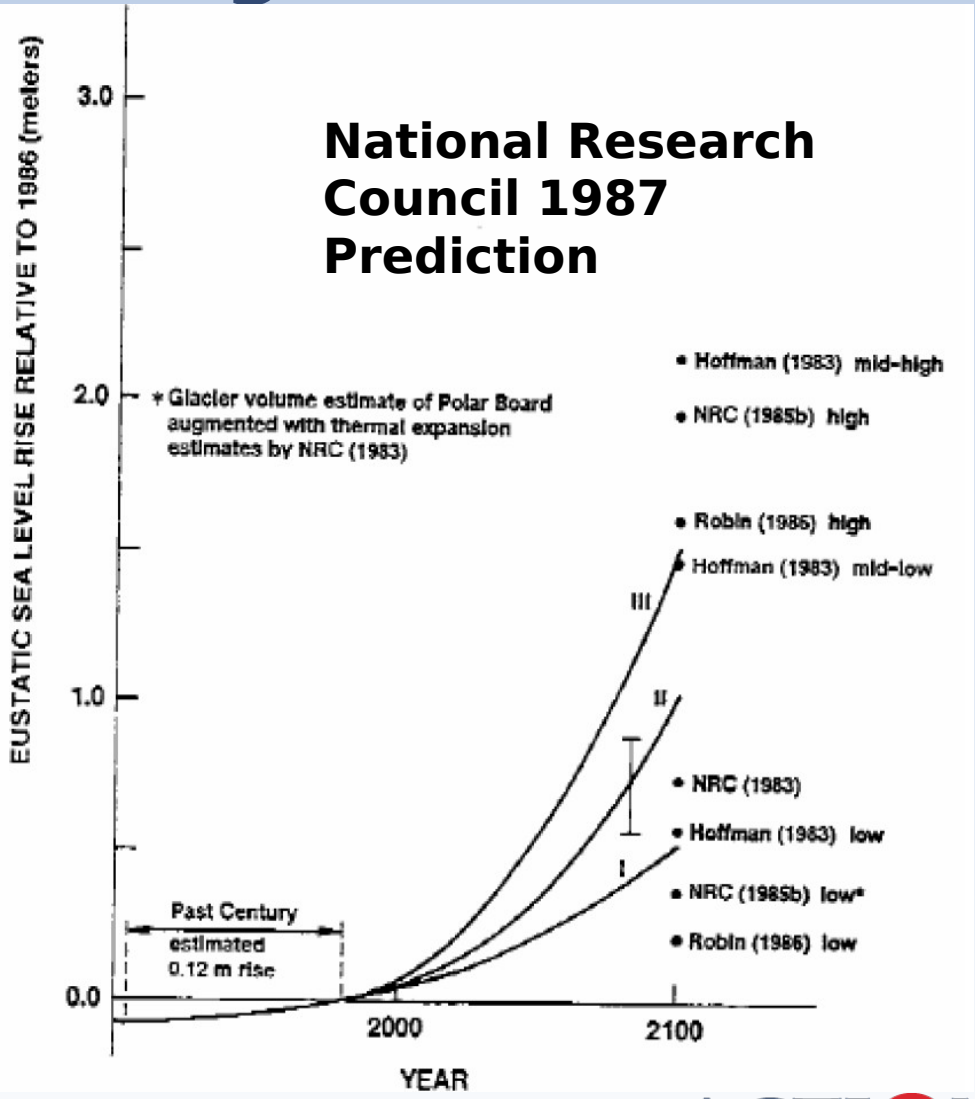
- **Observed increases in intense precipitation across the continental US**
- **Relatively few statistically significant trends for highest (flood) flows**
  - **Shifts in probability distribution of extreme precipitation in general correspond to shifts in flood distributions, but these “floods” are not of same general magnitude as annual maxima series**
  - **Shifts in intense precipitation occur mostly during periods of year when extreme floods are uncommon**

“Stationarity is Dead”

- **Article in Science by USGS scientists and others**
- **Assert that “stationarity is dead.”**
  - **Stationarity: time-invariant (or 1-year–periodic) probability density function.**
  - **“Stationarity is dead because substantial anthropogenic change of Earth’s climate is altering the means and extremes of precipitation, evapotranspiration, and rates of discharge of rivers.”**

Sea Level Change

- **Current Corps guidance: extrapolation of local, use historical record of relative sea level rise and use Curve III from the NRC report for sensitivity analysis.**



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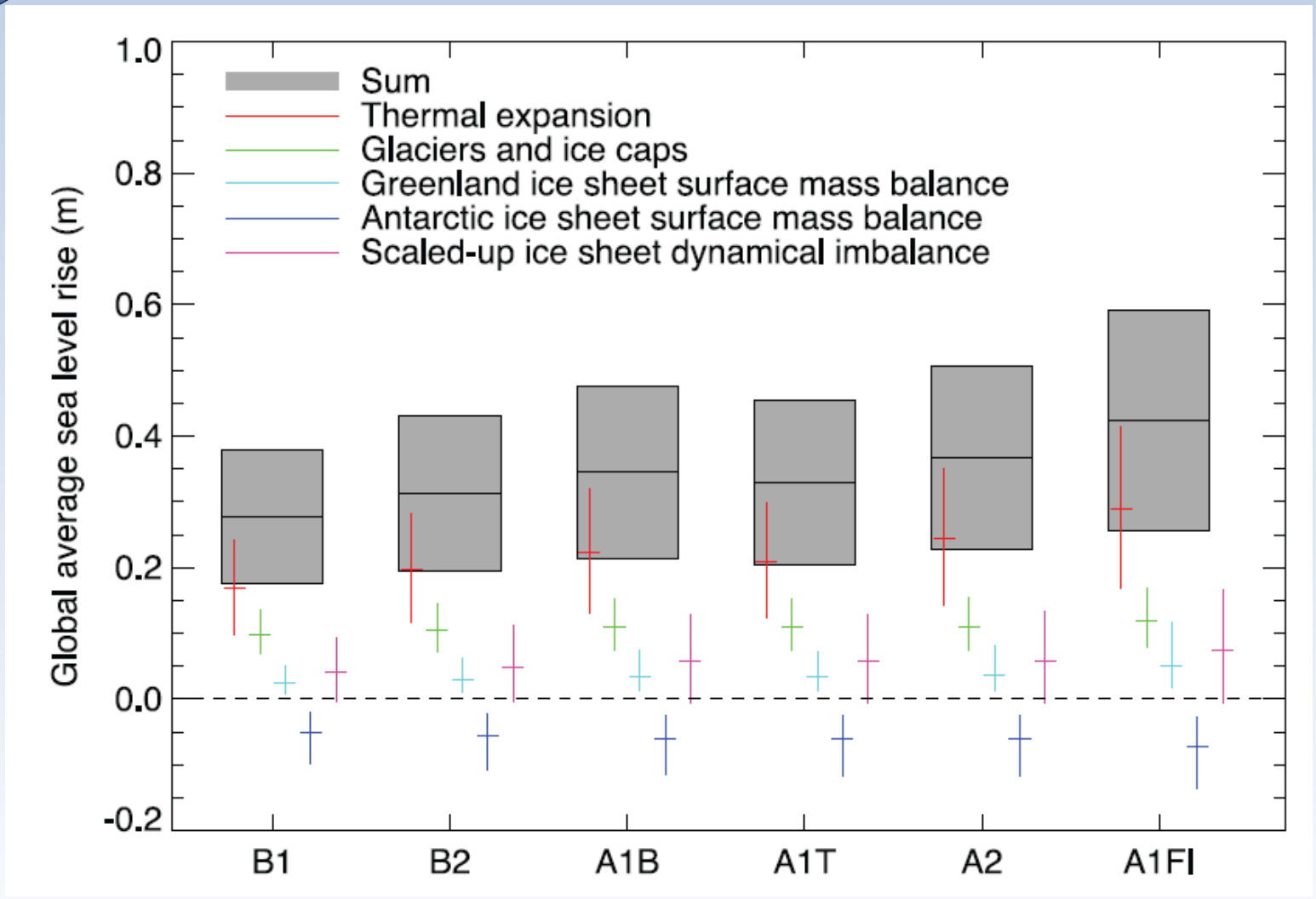
IPCC 2007 Projection



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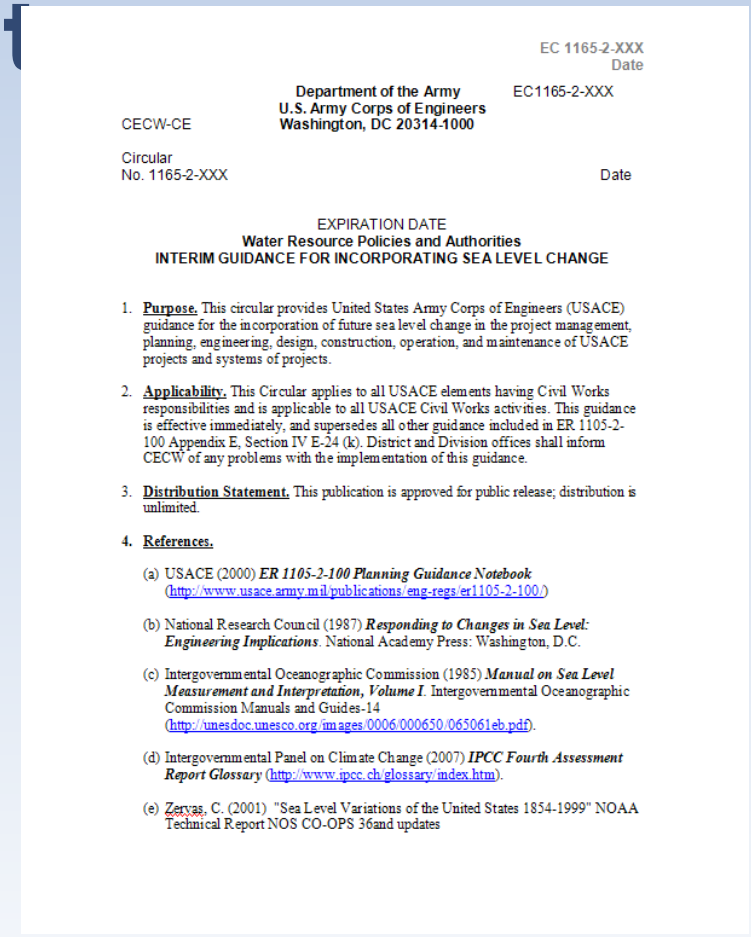
Climate Change and Coastal Projects

- **New guidance on sea level rise is top priority for FY08**
- **Interim Engineer Circular is being written**
- **Changes in frequency, intensity and tracking patterns of hurricanes and other coastal storms may have more impact on coastal systems than sea level rise alone**



EC 1165-2-XXX
Date

Department of the Army
U.S. Army Corps of Engineers
Washington, DC 20314-1000

EC1165-2-XXX

CECW-CE

Circular
No. 1165-2-XXX

Date

EXPIRATION DATE
Water Resource Policies and Authorities
INTERIM GUIDANCE FOR INCORPORATING SEA LEVEL CHANGE

1. **Purpose.** This circular provides United States Army Corps of Engineers (USACE) guidance for the incorporation of future sea level change in the project management, planning, engineering, design, construction, operation, and maintenance of USACE projects and systems of projects.

2. **Applicability.** This Circular applies to all USACE elements having Civil Works responsibilities and is applicable to all USACE Civil Works activities. This guidance is effective immediately, and supersedes all other guidance included in ER 1105-2-100 Appendix E, Section IV E-24 (k). District and Division offices shall inform CECW of any problems with the implementation of this guidance.

3. **Distribution Statement.** This publication is approved for public release; distribution is unlimited.

4. **References.**

   (a) USACE (2000) ***ER 1105-2-100 Planning Guidance Notebook*** (http://www.usace.army.mil/publications/eng-regs/er1105-2-100/)

   (b) National Research Council (1987) ***Responding to Changes in Sea Level: Engineering Implications***. National Academy Press: Washington, D.C.

   (c) Intergovernmental Oceanographic Commission (1985) ***Manual on Sea Level Measurement and Interpretation, Volume I***. Intergovernmental Oceanographic Commission Manuals and Guides-14 (http://unesdoc.unesco.org/images/0006/000650/065061eb.pdf).

   (d) Intergovernmental Panel on Climate Change (2007) ***IPCC Fourth Assessment Report Glossary*** (http://www.ipcc.ch/glossary/index.htm).

   (e) Zervas, C. (2001) "Sea Level Variations of the United States 1854-1999" NOAA Technical Report NOS CO-OPS 36and updates

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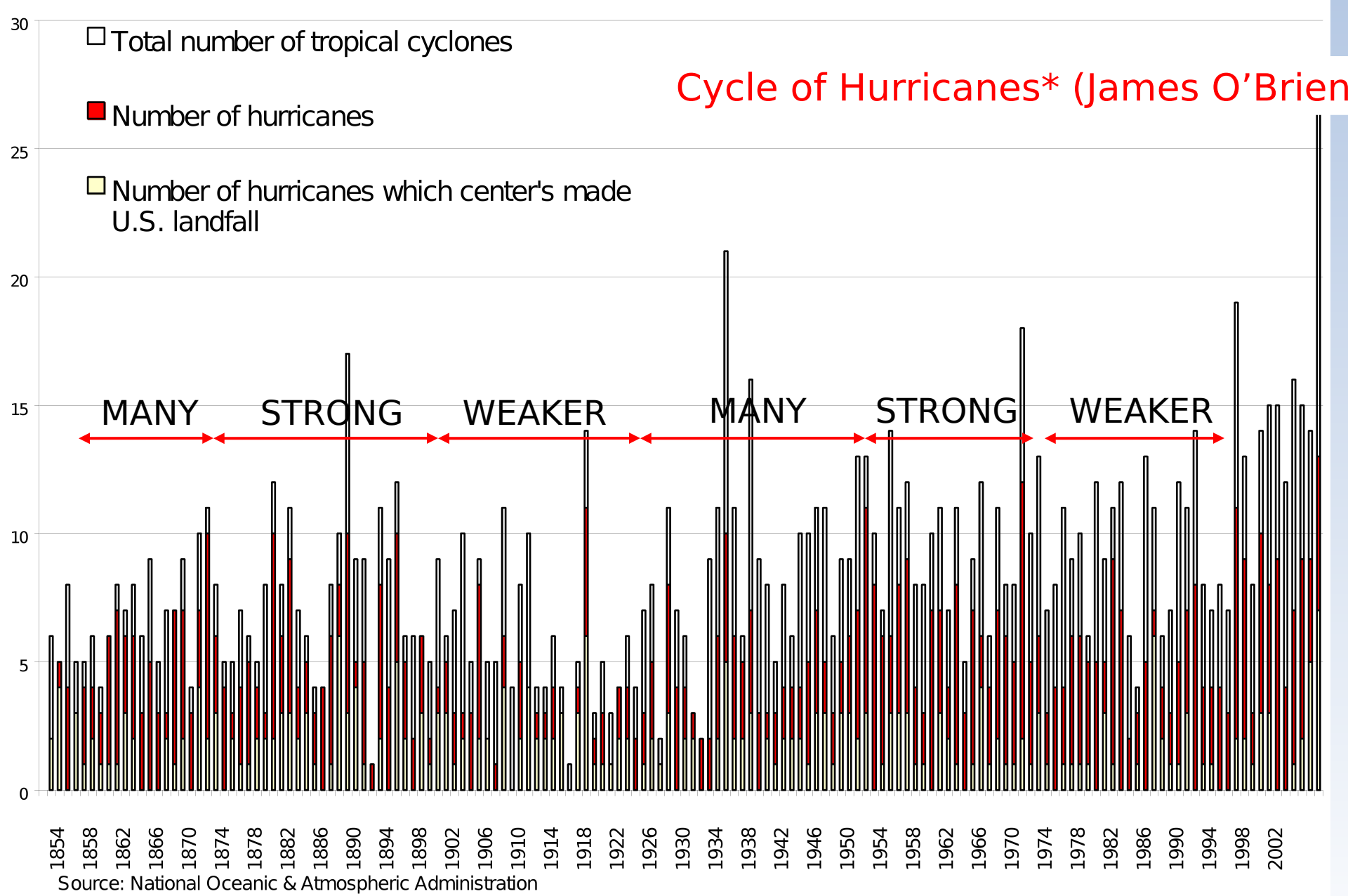
Cycle of Hurricanes* (James O'Brien

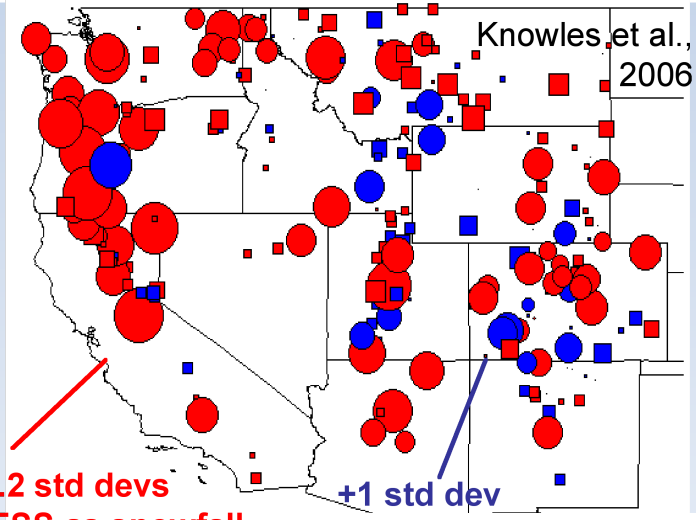


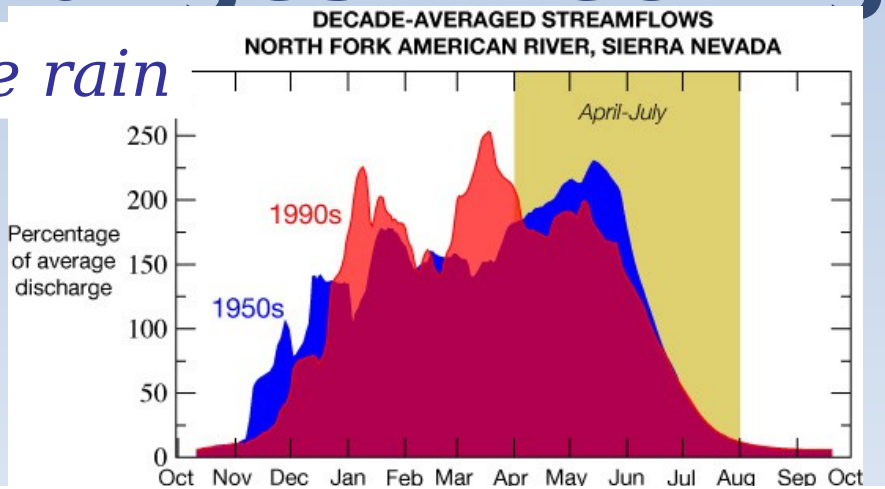
Source: National Oceanic & Atmospheric Administration

Note: Prior to 1970, tropical cyclones were not monitored by satellites; meaning that those cyclones that did not hit the land of the United States were not systematically recorded.

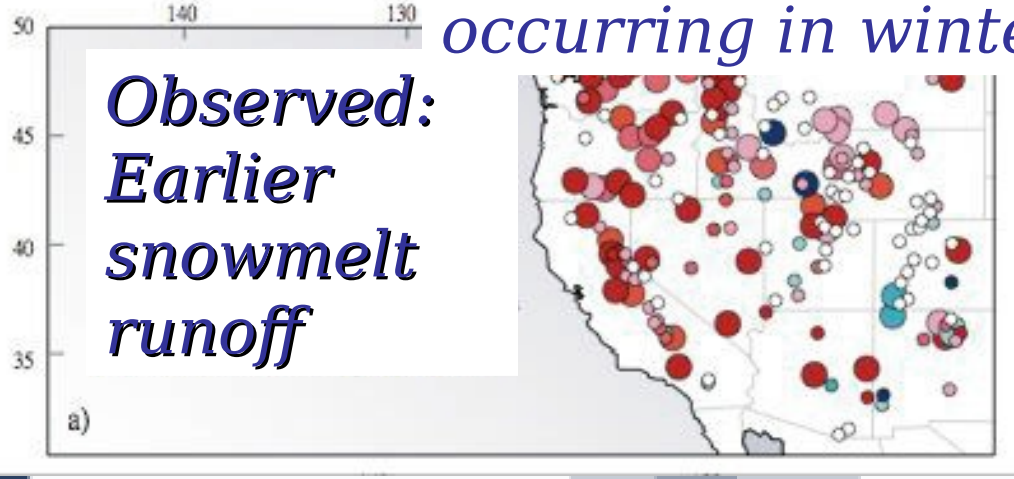
Observed Changes Affecting

Observed: Less snow/more rain





Observed: Percentage of average annual discharge occurring in winter



Observed: Earlier snowmelt runoff

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Recommendations

- **Better monitoring of snow and water conditions is needed for real time decision making**
- **Need funding to update reservoir operating plans**
- **Build flexibility into operations**
- **Forecasts can be improved on multiple timescales and more research needs to done on incorporating forecasts into reservoir operations**
- **Employ a systems perspective in updating reservoir operating manuals**

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USACE Activities for Climate Change

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Actions for Change Mission Statement

- **To effect fundamental change in the US Army Corps of Engineers (USACE) by developing and implementing an integrated, comprehensive and systems based approach in the execution of all its mission areas**
- **This change incorporates anticipatory and adaptive management to remain adaptable and sustainable over time, placing the highest priority on protection of public health and safety, consistent with the Environmental Operating Principles**

Actions for Change Theme 1: Comprehensive Systems Approach

- **The comprehensive system approach will shift the focus on making decisions from individual, isolated projects to an interdependent system, and from local or immediate solutions to regional or long-term solutions**

ACTIONS for CHANGE

Temporal and Spatial System Changes PDT

- **Adapt to changes by incorporating new information and knowledge throughout life cycle to ensure satisfactory system safety and performance**
- **Review policies, methods, and technologies related to dynamic temporal and spatial system changes that introduce uncertainty and reduce resilience**

Dynamic Conditions Affecting USACE

- **Types of changes that affect system reliability and risk:**
  - **Climate change and variability**
  - **Subsidence**
  - **Altered seismicity**
  - **Demographic changes and development**
  - **Land use changes and changes in rainfall-runoff characteristics**
  - **Channel migration**
  - **Social/cultural changes**

USACE Adaptations to Climate Change

- **USACE Policy, Procedures and Guidelines Team for Adaptations to Climate Change**
  - **Objectives**
    - **Develop consistent approaches to climate change throughout Corps and in partnership with other Federal agencies with regard to models and assumptions that are used to evaluate climate change impact analysis**
    - **Provide recommendations for Corps policy and guidance to prepare for and respond to climate change and variability**

ACTIONS for CHANGE

Interagency Workgroups on Climate Change

- **U.S. Army Corps of Engineers, U.S. Geological Survey (USGS), Bureau of Reclamation, National Oceanic and Atmospheric Administration (NOAA)**
  - **Mission of interagency workgroup on climate change and water resources:**
    - **To evaluate practices of federal agencies to incorporate climate change considerations into activities related to Nation's water resources**

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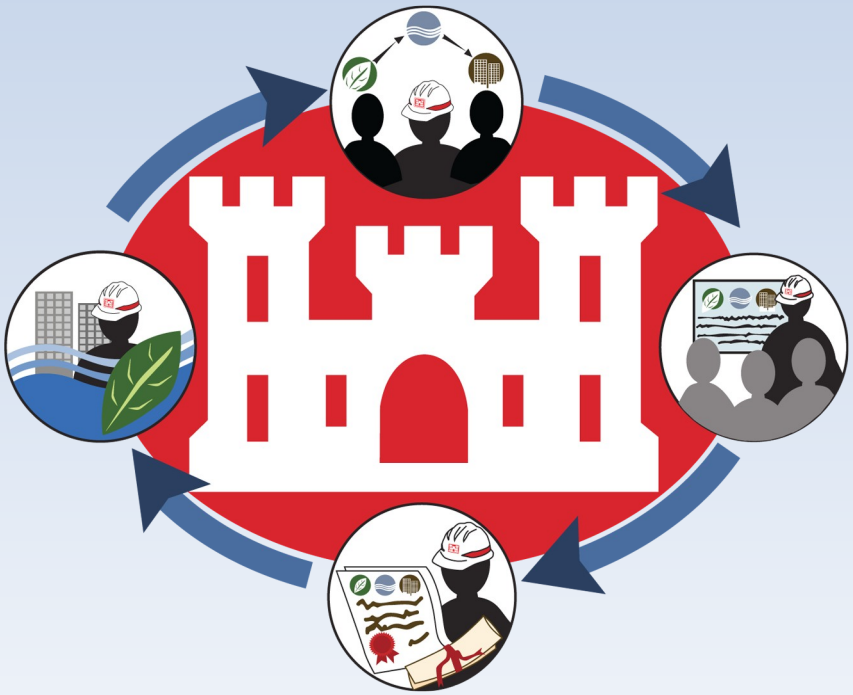
Other Interagency Groups

- **Climate Change Science Program (CCSP)**
- **EPA-initiated Federal Agency Workgroup on Coordination Options for Water Resources and Climate Change**
- **Climate Change and Western Water R&D Group (CCAWWG)**
- **Sea Level Change - USACE, USGS, NOAA-NOS, FEMA**
- **Climate Change Impacts Interagency Working Group (NASA, CERL, DOD)**

Long-term Changes in USACE Guidance

- **Resilient Strategies: Choose alternatives that perform well under a variety of possible future conditions**
- **Adaptive Management: Flexible decision making in face of uncertainties that is adjusted over time as events become better understood**
- **Anticipatory management: Flexibility to anticipate future conditions**

Questions?



To learn more about Actions for Change
visit us on the web at
https://maps.crrel.usace.army.mil/AFC/

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